

What is claimed is:

1. An article comprising diamond deposited on a framework material substrate, said article at least partially filled with a filler material.

5 2. The article of claim 1 wherein said framework material substrate comprises a material compatible with a diamond deposition process.

3. The article of claim 1 wherein said framework material substrate comprises a material incompatible with a diamond deposition process coated with a material compatible with a diamond deposition process.

10 4. The article of claim 1 wherein said diamond has a thickness of at least about 2 microns.

15 5. The article of claim 1 wherein said diamond is fully coalesced.

6. The article of claim 1 wherein said filler material substantially completely fills voids in said article.

7. The article of claim 1 wherein said filler material is chosen from the group including organic materials, inorganic ceramic materials, magnetic materials, and metallic materials.

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8. An article comprising diamond doped with non-diamond material deposited on a framework material substrate.

9. The article of claim 8 wherein said framework material substrate comprises a material compatible with a diamond deposition process.

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10. The article of claim 8 wherein said framework material substrate comprises a material incompatible with a diamond deposition process coated with a material compatible with a diamond deposition process.

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11. The article of claim 8 wherein said diamond doped with non-diamond material has a thickness of at least about 2 microns.

12. The article of claim 8 wherein said diamond doped with non-diamond material is fully coalesced.

13. The article of claim 8 wherein said article is at least partially filled with
5 a filler material.

14. The article of claim 13 wherein said filler material substantially completely fills voids in said article.

10 15. The article of claim 13 wherein said filler material is chosen from the group including organic materials, inorganic ceramic materials, magnetic materials, and metallic materials.

16. The article of claim 8 wherein said non-diamond material is at least one
15 non-diamond material chosen from the group including phosphorus, lithium, arsenic, hydrogen, silicon, boron, carbon, sulfur and beryllium.

17. An article comprising diamond deposited on a open-cell foam substrate, said article having voids therein, said voids at least partially filled with a filler material.

5 18. The article of claim 17 wherein said framework material substrate comprises a material compatible with a diamond deposition process.

10 19. The article of claim 17 wherein said framework material substrate comprises a material incompatible with a diamond deposition process coated with a material compatible with a diamond deposition process.

20. The article of claim 17 wherein said diamond has a thickness of at least about 2 microns.

15 21. The article of claim 17 wherein said diamond is fully coalesced.

22. The article of claim 17 wherein said filler material substantially completely fills said voids in said article.

23. An article comprising diamond doped with non-diamond material deposited on a open-cell foam substrate, said article having voids therein.

5 24. The article of claim 23 wherein said framework material substrate comprises a material compatible with a diamond deposition process.

25. The article of claim 23 wherein said framework material substrate comprises a material incompatible with a diamond deposition process coated with a
10 material compatible with a diamond deposition process.

26. The article of claim 23 wherein said diamond doped with non-diamond material has a thickness of at least about 2 microns.

15 27. The article of claim 23 wherein said diamond doped with non-diamond material is fully coalesced.

28. The article of claim 23 wherein said voids in said article are at least partially filled with a filler material.

29. The article of claim 28 wherein said filler material substantially completely fills voids in said article.

30. The article of claim 28 wherein said filler material is chosen from the group including organic materials, inorganic ceramic materials, magnetic materials, and metallic materials.

31. The article of claim 23 wherein said non-diamond material is at least one non-diamond material chosen from the group including phosphorus, lithium, arsenic, hydrogen, silicon, boron, carbon, sulfur and beryllium.

32. An article comprising diamond deposited on a framework material substrate, said diamond at least partially coated with a catalytic material.

33. The article of claim 32 wherein said framework material substrate comprises a material compatible with a diamond deposition process.

34. The article of claim 32 wherein said framework material substrate
5 comprises a material incompatible with a diamond deposition process coated with a material compatible with a diamond deposition process.

35. The article of claim 32 wherein said diamond has a thickness of at least about 2 microns.

36. The article of claim 32 wherein said catalytic material is chosen from the group including palladium, zeolites, enzymes, antibodies, titanium dioxide, and the platinum group elements and alloys thereof.

37. A method for forming a porous diamond article comprising:
providing a porous substrate;
preparing said porous substrate for diamond deposition;

depositing diamond material on said porous substrate to produce an article having voids therein; and

at least partially filling said voids with a filler material.

5 38. The method of claim 37 wherein providing a porous substrate comprises providing a foam substrate.

39. The method of claim 37 wherein depositing diamond material on said porous substrate comprises depositing diamond to a thickness of at least about 2
10 microns.

40. The method of claim 37 wherein depositing diamond material on said porous substrate comprises depositing diamond until said diamond is fully coalesced.

15 41. The method of claim 37 wherein depositing diamond material on said porous substrate comprises depositing diamond to a thickness such that the porosity of said article is at least 100 voids/inch.

42. The method of claim 37 wherein depositing diamond material on said porous substrate comprises depositing diamond material by microwave assisted plasma deposition.

5 43. The method of claim 37 wherein depositing diamond material on said porous substrate comprises depositing diamond material by arc plasma torch deposition.

10 44. The method of claim 37 wherein depositing diamond material on said porous substrate comprises depositing diamond material by hot filament diamond deposition.

15 45. The method of claim 37 wherein depositing diamond material on said porous substrate comprises depositing diamond material by RF assisted plasma deposition.

46. The method of claim 37 wherein at least partially filling said voids with a filler material comprises substantially filling said voids with said filler material.

47. A method for forming a diamond foam article comprising:
providing a porous substrate;
preparing said porous substrate for diamond deposition; and
5 depositing diamond doped with non-diamond material on said porous
substrate to produce an article having voids therein.
48. The method of claim 47 wherein providing a porous substrate comprises
providing a foam substrate.
- 10 49. The method of claim 47 wherein depositing diamond doped with non-
diamond material on said porous substrate comprises depositing diamond doped with
non-diamond material to a thickness of at least about 2 microns.
- 15 50. The method of claim 47 wherein depositing diamond doped with non-
diamond material on said porous substrate comprises depositing diamond until said
diamond doped with non-diamond material is fully coalesced.

51. The method of claim 47 wherein depositing diamond doped with non-diamond material on said porous substrate comprises depositing diamond doped with non-diamond material to a thickness such that the porosity of said article is at least 100 voids/inch.

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52. The method of claim 47 wherein depositing diamond doped with non-diamond material on said porous substrate comprises depositing diamond doped with non-diamond material by microwave assisted plasma deposition.

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53. The method of claim 47 wherein depositing diamond doped with non-diamond material on said porous substrate comprises depositing diamond doped with non-diamond material by arc plasma torch deposition.

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54. The method of claim 47 wherein depositing diamond doped with non-diamond material on said porous substrate comprises depositing diamond doped with non-diamond material by hot filament diamond deposition.

55. The method of claim 47 wherein depositing diamond doped with non-diamond material on said porous substrate comprises depositing diamond doped with non-diamond material by RF assisted plasma deposition.

5 56. A method for forming a porous diamond article comprising:
providing a porous substrate;
preparing said porous substrate for diamond deposition;
depositing diamond material to produce an article having voids therein;
and
10 coating said diamond material with a catalytic material.

57. The method of claim 56 wherein providing a porous substrate comprises providing a foam substrate.

15 58. The method of claim 56 wherein depositing diamond material on said porous substrate comprises depositing diamond to a thickness of at least about 2 microns.

59. The method of claim 56 wherein depositing diamond material on said porous substrate comprises depositing diamond until said diamond is fully coalesced.

60. The method of claim 56 wherein depositing diamond material on said porous substrate comprises depositing diamond to a thickness such that the porosity of said article is at least 100 voids/inch.

61. The method of claim 56 wherein depositing diamond material on said porous substrate comprises depositing diamond material by microwave assisted plasma deposition.

62. The method of claim 56 wherein depositing diamond material on said porous substrate comprises depositing diamond material by arc plasma torch deposition.

63. The method of claim 56 wherein depositing diamond material on said porous substrate comprises depositing diamond material by hot filament diamond deposition.

64. The method of claim 56 wherein depositing diamond material on said porous substrate comprises depositing diamond material by RF assisted plasma deposition.

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65. The method of claim 56 wherein coating said diamond material with a catalytic material comprises coating said diamond material with catalytic material to a thickness of at least about 0.2 microns.

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66. A method for preparing a diamond foam material article for soldering or brazing to material capable of being soldered or brazed comprising:

providing the diamond foam material article;

coating a region of said diamond foam material to be soldered to the other material with at least one metal to render the diamond foam capable of

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sustaining an adhesive solder bond.

67. The method of claim 66 wherein coating said region of said diamond foam material article to be soldered to the other material with at least one metal

comprises coating said region of said diamond foam material article with a plurality of metals.

68. The method of claim 67 wherein coating said region of said diamond
5 foam material article with a plurality of metals comprises:

first coating said region of said diamond foam material article with a layer of titanium;

next coating said region of said diamond foam material article with a layer of platinum; and

10 next coating said region of said diamond foam material article with a layer of gold.

exclude air from contact with the diamond foam during the formation of the braze bond to preclude oxidation of the diamond foam.

15 69. A method for soldering a diamond foam material article to a solderable material article comprising:

providing the diamond foam material article;

providing a solderable material article;

coating a region of said diamond foam material to be soldered to said solderable material article with at least one metal to render the diamond foam capable of sustaining an adhesive solder bond; and

5 soldering said region of the diamond foam article to said solderable material article.

70. A method for brazing a diamond foam material article to a brazeable material article comprising:

10 providing the diamond foam material article;

providing the brazeable material article;

coating a region of said diamond foam material to be brazed to said brazeable material article with at least one metal to render the diamond foam capable of sustaining an adhesive braze bond; and

15 brazing said region of the diamond foam article to said brazeable material article in an atmosphere substantially free of oxygen.

71. A method for bonding a diamond foam material article to a component having at least a region of diamond film at an attachment surface thereof comprising:

providing the diamond foam material article;
providing the component;
placing said diamond foam material article and said component in
contact at said attachment surface in a diamond-growth reaction chamber on a support
5 positioned to permit the formation of a plasma in close proximity with a plane
describing the juxtaposition of the diamond foam material article and said attachment
surface of said component; and
depositing at least about 0.1 millimeter of diamond so as to fuse said
diamond foam material article to said component to form an integral structure.

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72. An article comprising a diamond foam material article soldered to a
solderable material article.

73. The article of claim 72 wherein said diamond foam material article is
15 soldered to said solderable material article at a surface region formed from a material
selected from the group including metals, metal alloys, semiconducting materials,
ceramics, and cermet materials.

74. An article comprising a diamond foam material article brazed to a brazeable material article.

75. The article of claim 74 wherein said diamond foam material article is
5 brazed to said brazeable material article at a surface region formed from a material selected from the group including metals, metal alloys, semiconducting materials, ceramics, and cermet materials.

76. An article comprising a diamond foam material article bonded by
10 diamond material to a component at an attachment surface of said component formed from a diamond film.

77. The article of claim 76 wherein said component is formed from
diamond.

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78. The article of claim 76 wherein said component is formed from a material other than diamond having a diamond film deposited on at least said attachment surface thereof.

79. An article comprising a diamond foam material article adhesively bonded to a component at an attachment surface of said component.